

HEAT EXCHANGER FOR A REFRIGERATION DEVICE

The present invention relates to a heat exchanger with a base plate, a tubular pipe for a coolant attached to the base plate and a sleeve arranged on the base plate for receiving a temperature sensor and a refrigeration device, fitted with such a heat exchanger. Such a heat exchanger can be utilised in a refrigerating machine as liquefier, though in particular as evaporator.

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To regulate the operation of such an evaporator controlled by temperature, a temperature sensor, connected to a thermostat regulating circuit, is generally mounted on the evaporator. This thermostat regulating circuit switches the refrigerating machine on and off, so that the temperature recorded by the temperature sensor remains in a set range. The temperature recorded by the temperature sensor generally has systematic deviations from the actual temperature of the evaporator and follows those changes with a delay. These systematic deviations depend inter alia on the heat conductivity of the transition from the evaporator to the temperature sensor, from removing the temperature sensor from the coolant pipe of the evaporator etc..

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To guarantee uniform regulating performance of heat exchangers produced in series, the sleeve, which is provided to receive the temperature sensor, when the evaporator is mounted in a refrigeration device, must have the same position in each evaporator with respect to the coolant pipe extending along the evaporator plate. With roll-bonding evaporators the reproducible positioning of the sleeve can be easily ensured with respect to the run of the coolant pipe, in that a coolant duct and a duct for receiving a temperature sensor are jointly stamped in one of the two sheets to be attached to one another of such an evaporator. Such a technique is known e.g. from DE 39 28

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471 C2. However, it is not transferable to tube-plate evaporators, i.e. to evaporators, which are made up of an evaporator plate, on the surface whereof a tubular pipe for the coolant is attached.

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In such evaporators it is possible to stick on a duct for subsequently receiving a temperature sensor, e.g. in the form of a sheet metal or plastic pipe, however this can not take place in one procedure together with attaching the  
10 coolant pipe, so that reproducible positioning of such a duct with respect to the coolant pipe and thus uniform regulating performance is not easily guaranteed.

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Another option is to form a duct, by rolling up the base plate into a duct for the temperature sensor. In this way the position of the temperature sensor is fixed with respect to the base plate, yet this is so restricting that the temperature sensor can be positioned only at the edge of the base plate, thus in a region, which is subject to  
20 relatively strong interfering thermal influences from the outside and whereof the temperature allows a flux guide on the medium temperature of the base plate in only a limited way.

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The object of the present invention is to provide a heat exchanger for a refrigeration device in tube plate technique, which allows reproducible positioning of a receiving sleeve for a temperature sensor simply and without the necessity of position measuring or adjustment.

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This task is solved by a heat exchanger having the features of Claim 1. The position of the sleeve is precisely fixed at a distance from the tubular pipe, which corresponds to the length of the brace by the sleeve of the surface of the  
35 evaporator plate is fixed by least one brace engaging on the tubular pipe in this heat exchanger. Thus the delay, with which a temperature sensor mounted in the sleeve

registers heating or cooling of the coolant pipe, is uniform for all evaporators manufactured in series with the same length of brace.

- 5 Assembly of the heat exchanger is simplified if each brace has a clamping section for clamping on the tubular pipe. This enables rapid preliminary fixing of the sleeve on the base plate; definitive fixing, in particular by covering the side of the base plate bearing the tubular pipe and the  
10 sleeve by a covering layer or film, can take place at a later point in time.

- As a result of a first preferred configuration the sleeve and at least one brace are designed monobloc, and  
15 preferably from a sheet metal blank made of a flat material such as in particular sheet metal.

- Based on a second preferred configuration the brace is made as a part separated from the sleeve and is clamped to the  
20 latter. Such a brace can in particular have a first clamping section for clamping on the tubular pipe and a second clamping section for clamping on the sleeve.

- To prevent the sleeve with respect to the coolant pipe, to  
25 which it is fixed, the sleeve is preferably assigned at least two braces.

- These two braces can extend out from the sleeve in the same direction, in particular to engage on the same straight  
30 pipe section, running parallel to the sleeve, but it can also extend out from the sleeve in opposite directions in order to engage on two different sections of the tubular pipe, extending on both sides of the sleeve.

- 35 To fix the assembly position of the sleeve in a longitudinal direction of the tubular pipe also, it can be provided that the tubular pipe bears a marking at the point

of application of at least one brace. Such a marking can in particular be a notch or indentation, which has been pressed in during fastening of the tubular pipe on the evaporator plate at a preset point in the tubular pipe, and  
5 in which the clamping section of the brace can latch, so that it is secured against the tubular pipe slipping in a longitudinal direction.

The tubular pipe and the sleeve can be connected simply by  
10 an adhesive layer to the evaporator plate.

The tubular pipe and the sleeve are preferably enclosed between the evaporator plate on the one hand and a film of deformable material such as bitumen, plastic material or  
15 aluminium on the other hand.

Further features and advantages of the invention will emerge from the following description of embodiments with respect to the attached figures, in which:

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Figure 1 is a perspective view of an evaporator according to a first configuration of the invention;

Figure 2 is a section along line II-II from Figure 1;

Figure 3 is a perspective view of the sleeve incorporated  
25 in the evaporator of Figure 1;

Figure 4 is a view similar to Figure 1 of a second configuration of an inventive evaporator;

Figure 5 is a section along line V-V of Figure 4;

Figure 6 is a perspective view of the sleeve used in the  
30 configuration of Figure 4; and

Figure 7 is a perspective view of a variation of the sleeve of Figure 6.

The heat exchanger shown in perspective view in Figure 1  
35 and provided as evaporator for a refrigeration device is composed of a level base plate 1 of sheet aluminium, on which a coolant pipe 2 likewise comprising an aluminium

- pipe 1 is arranged in a meander. The base plate 1 and the coolant pipe 2 are covered by a holding material layer 3, which comprises e.g. a mixture of bitumen, additives for adjusting a desired heat capacity and/or heat conductivity of the holding material layer 3 and optionally other additives influencing the workability of the layer 3. The proportion of the bitumen on the layer 3 can be less than that of the additives.
- 10 Instead of bitumen the holding material layer 3 could also comprise a plastic material such as polyethylene, and if required with corresponding additives, or a strong aluminium foil.
- 15 As the cross-section of Figure 2 shows, the holding material layer 3 extends as far as into the panaches 4, which lie on both sides of the contact line between the coolant pipe 2 and the base plate 1 and thus contributes substantially to efficient heat transfer between the base plate 1 and the coolant pipe 2. To minimise the thickness of the holding material layer 3 in the panaches 4 and thus to further improve the heat transfer, the coolant pipe 2 has a flattened elliptical cross-section, which can e.g. be obtained by an originally round coolant pipe being pressed flat after the base plate 1 is laid or during laying on the latter.
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- Located between the holding material layer 3 and the coolant pipe 2 on the one hand and the base plate 1 on the other hand is a layer 5 of hot-melt adhesive, which is recognisable in the figure merely as a line due to its substantially lesser thickness compared to the base plate 1 and the holding material layer 3.
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- 35 A duct 6 for receiving a temperature sensor is arranged in a cavity between two parallel sections of the coolant pipe 2 parallel thereto. The duct 6 is formed by a sleeve 7

rolled from a sheet blank, and which is shown in Figure 2 in section and in Figure 3 in a perspective view. The sheet blank, from which the sleeve 7 is formed, has the form of a double Ts (or of the Greek letter  $\pi$ ), whereby the crossbeams of the two Ts are rolled up into the sleeve 7 and the legs form two braces 8, which keep the sleeve 7 at a preset distance from a section of the coolant pipe 2 parallel to the latter. The braces 8 in each case have a straight intermediate section 10, which sticks to the hot-melt layer 5 in the ready-mounted heat exchanger, and attached to the latter have a clamping section 9 in the form of a reversed U, whereof the two legs are clamped onto the coolant pipe 2 and in the process are elastically deformed. During assembly of the heat exchanger this form of the sleeve 7 allows it to be placed at a distance preset by the length of the intermediate section 10 from the coolant pipe 2, without having to measure up. The clamping section 9 provides a provisory hold for the sleeve 7 on the sheet metal blank during assembly, before the holding material layer 3 has been placed and the hot-melt layer 5 has been heated in order to connect the holding material to the base plate 1.

Provisory holding of the sleeve 7 on the coolant pipe 2 can naturally also be achieved using a single brace 8. If the width of such a single brace were the same as the distance between the two longitudinal edges of the braces 8 averted from one another in Figure 3, the same precision of parallel alignment of the sleeve 7 with the coolant pipe 2 could also be achieved as with two braces. Yet the use of two parallel braces 8 is preferred, because the holding material layer 3 can be stuck on the hot-melt layer 5 in the cavity between the two braces 8.

To fix the position of the sleeve 7 in the longitudinal direction of the coolant pipe 2 also, two depressions (not shown), whereof the width in each case corresponds to the

width of one brace 8 and whereof the distance from one another corresponds to the distance of the braces 8 from one another, are pressed into the latter preferably on their side averted from the base plate 1. These two  
5 depressions can serve as reference for placing the sleeve 7.

A second configuration of the inventive heat exchanger is explained by means of Figures 4 to 6, which in each case  
10 show views similar to Figures 1 to 3. Here too the sleeve 7 is clamped tight on the coolant pipe 2 by way of two braces 8, though the two braces 8 extend out from the sleeve 7 in each case in opposite directions and engage on two parallel sections of the coolant pipe 2. The structure of the braces  
15 8 with intermediate piece 10 and clamping section 9 is the same as in the first configuration. Clamping on two parallel sections of the coolant pipe 2 at the same time prevents the sleeve 7 from coming loose again during assembly, if the base plate 1 is tipped before adhesion.

20 A variant of this second configuration is shown in Figure 7. Other than in the previously described configuration the sleeve 7 and the braces 8 here are not bent in one piece from sheet metal, rather the sleeve is formed by a pipe  
25 piece 11, which is held pressed by a spring steel sheet strip the sheet metal blank 1, in which the two braces 8 engaging on the coolant pipe 2 are designed.

The length of the sleeve in all configurations aligns with  
30 the length of a temperature sensor to be arranged therein, which is conventionally ca. 160 mm.

Also the composition of the heat exchanger is extensively the same in all three configurations. After the sleeve has  
35 been clamped tight on the coolant pipe 2, a film is laid on the array of sheet metal blank 1, coolant pipe 2 and sleeve 7, and is provided to form the holding material layer 3. By

means of a stamp, in which recesses are formed corresponding to the run of the coolant pipe 2 on the sheet metal blank 1 and the form of the sleeve 7, the film is pressed against the hot-melt layer 5 and heated at the same  
5 time so as to activate the hot-melt adhesive and thus to stick the film and the intermediate pieces 10 of the braces.

When the material of the film becomes soft from the  
10 activation temperature of the hot-melt layer 5 and has adequate thickness, hydrostatic pressure can also be exerted on the film to cause material of the film to penetrate in the panache 4 between the coolant pipe 2 and the sheet metal blank 1. To be able to mount the  
15 temperature sensor in the sleeve, it suffices to cut off the holding material layer 3 at one end of the sleeve; it can also be used to press a stamp from the film, which is formed such that it tears open the film at one end of the sleeve.